

Final HCAL plots for publication

Abhisek Sen

HCAL - DATASET

❖ Standalone:

- Only with inner and outer HCAL.

❖ Joint:

- With EMCAL & HCAL

3 available datasets

❖ Tilting:

- Tilted +/- 5 degree (Joint)

Hadron Selection: (common to all dataset)

Cherenkov cut: $C2_{inner} < 20$

No hit in the veto counter ($ADC < 15$)

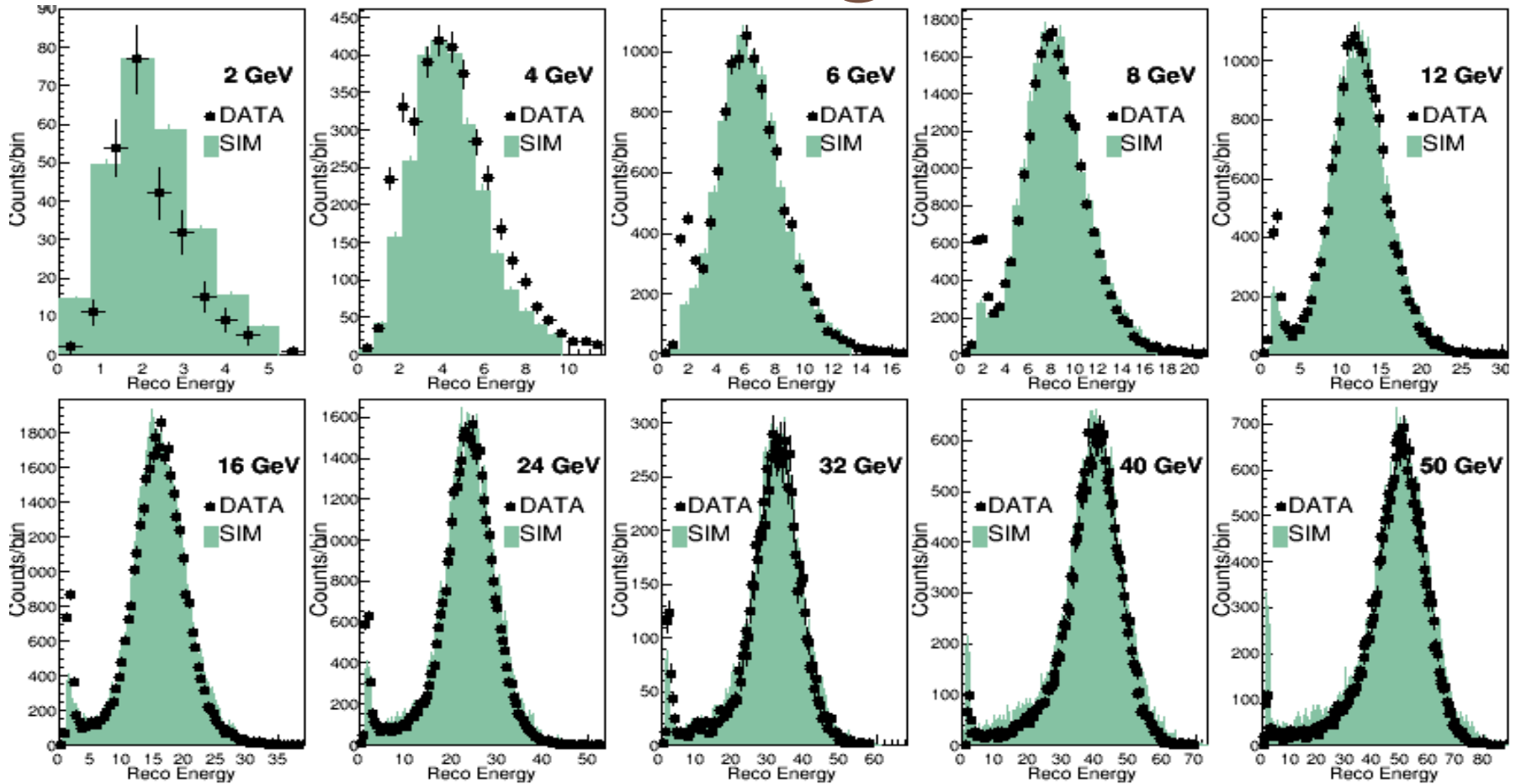
Valid Single hodoscope fired (V/H)

Code:

<https://github.com/sPHENIX-Collaboration/analysis/tree/master/Prototype2/HCAL/ShowerCalib>

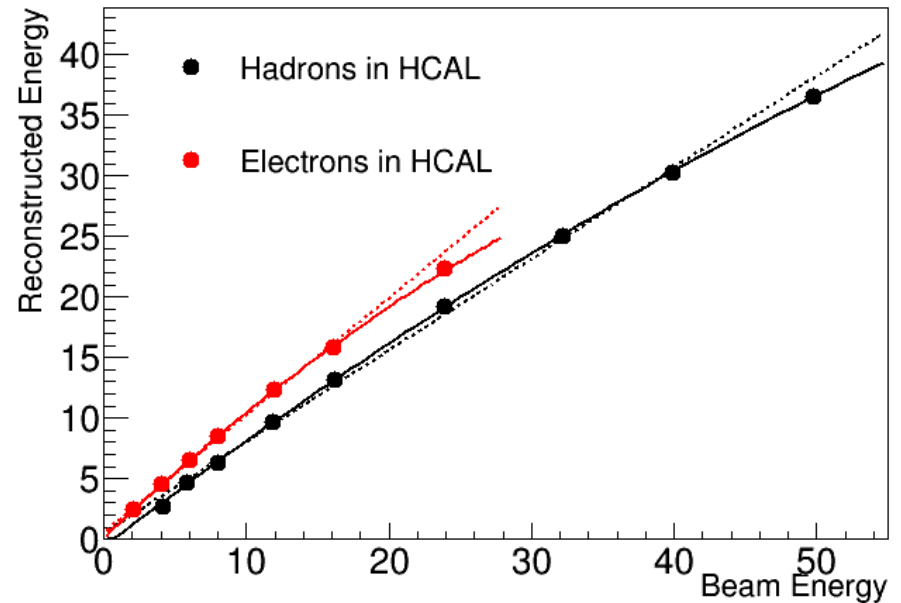
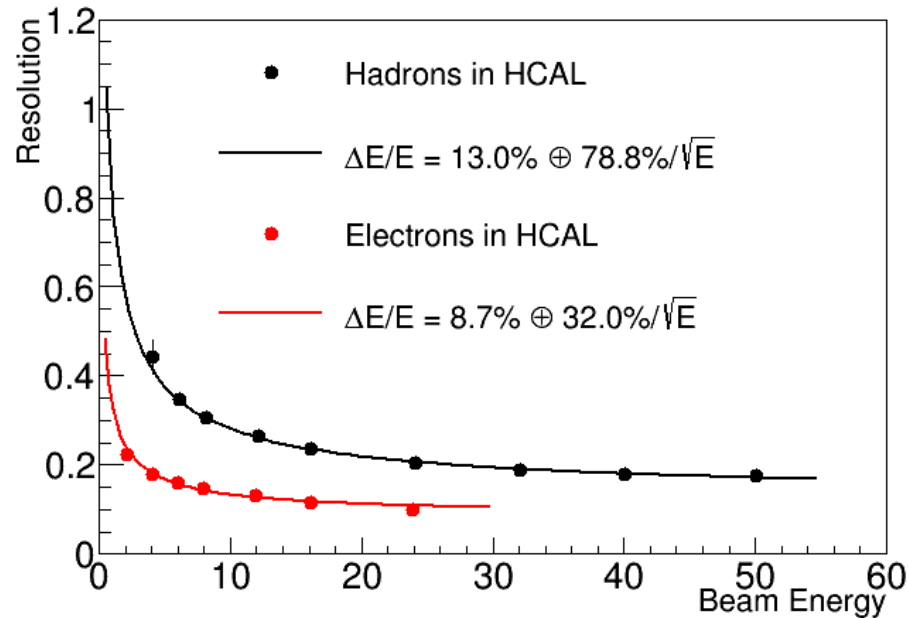
Standalone HCAL

Hadron signals



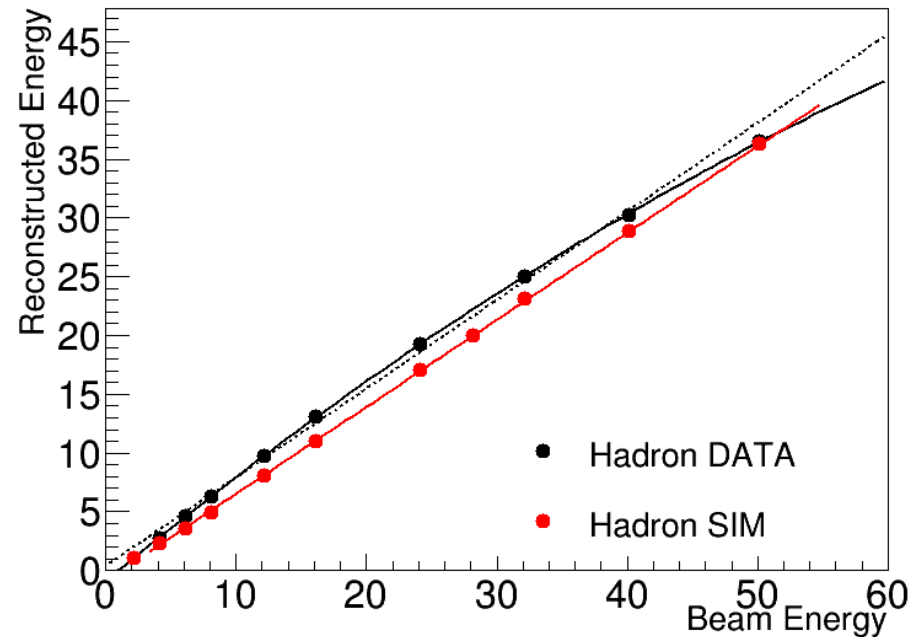
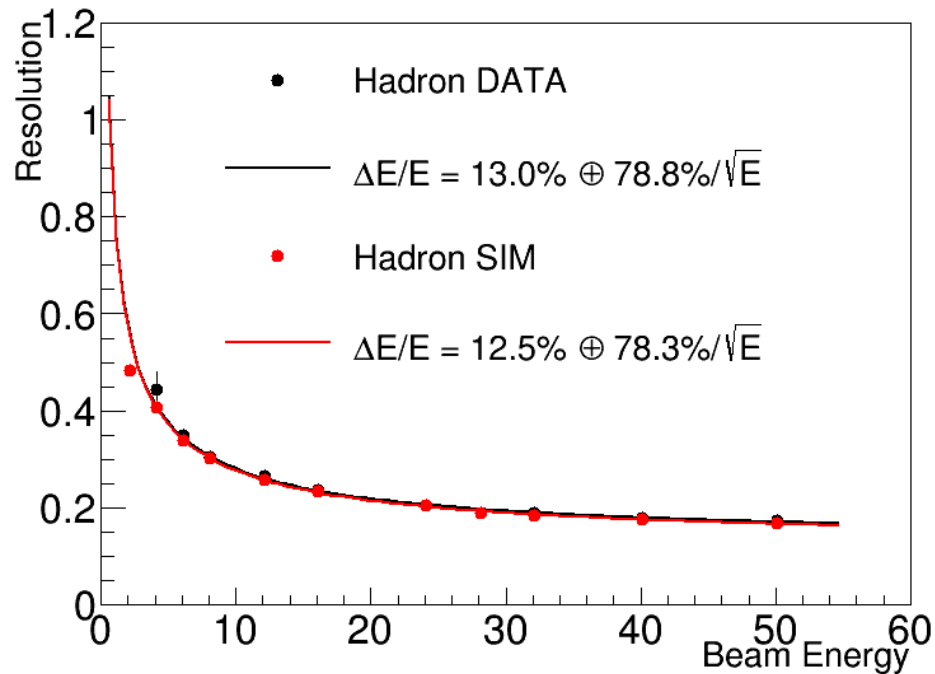
- Best way to represent our measurements is to show full comparison at all the energies.
- The high tail in the low energies is due to higher hadron shower fluctuations.
- The low tail in the high energies is due to leakage at the back of the calorimeter.

Resolution and Linearity



- Calibration:
 - Cosmic calibration for tower to tower variations.
 - A extra weight of 2 applied to the inner HCAL to balance two sections across all the energies.
- A small systematic error can be extracted on the resolution because tails [ignored till now].
- Low energy hadrons have significant beam momentum spread, no unfolded.
- Electron data was only available from 2-24 GeV because of the Cherenkov threshold.
- Response is not linear. A polynomial order 2 fits better than straight line.

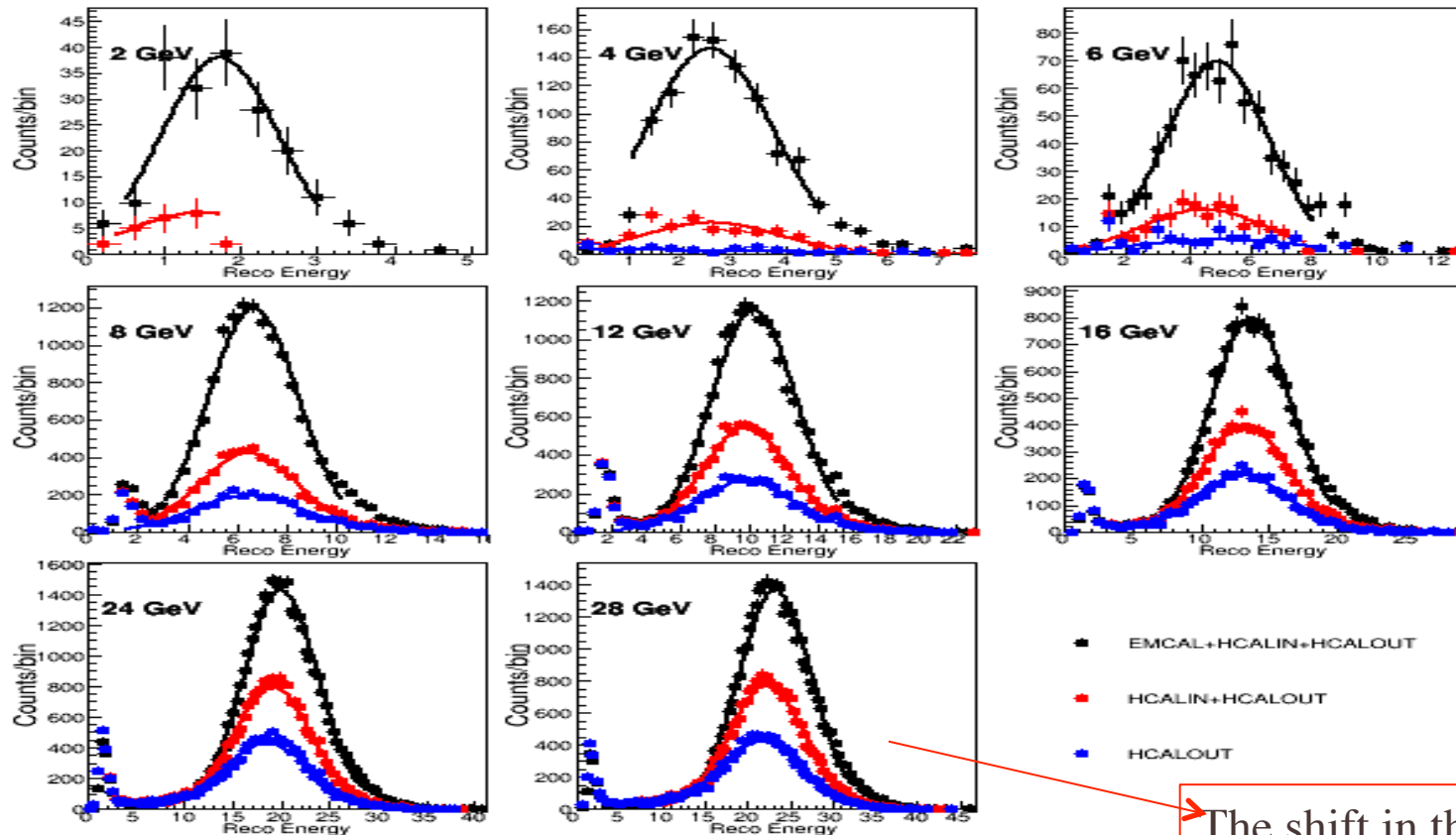
Comparison with simulation



- As expected, excellent matching of the simulation and data.
- Simulation is linear while data is not.

Joint (EMCAL+HCAL)

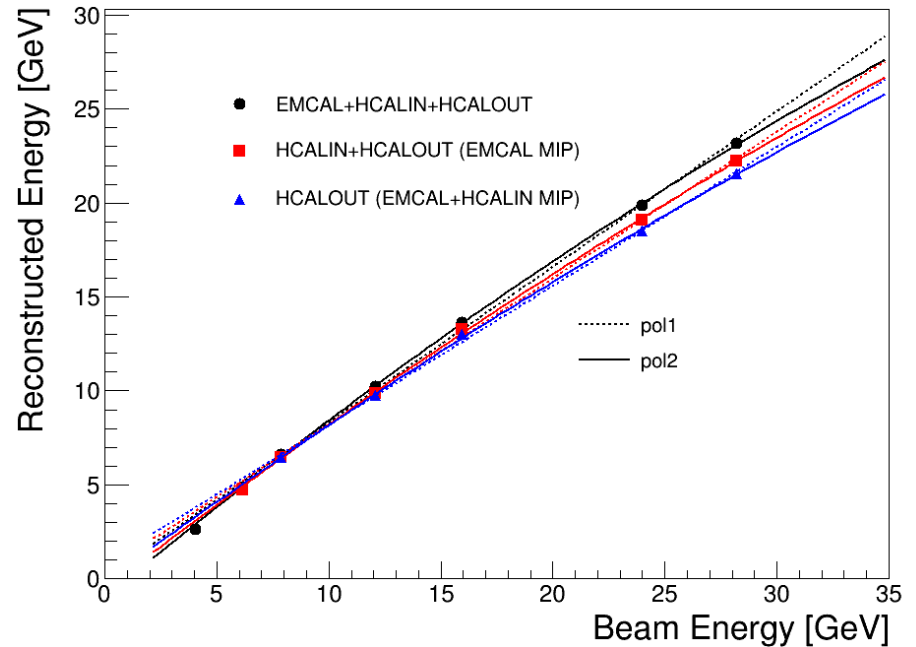
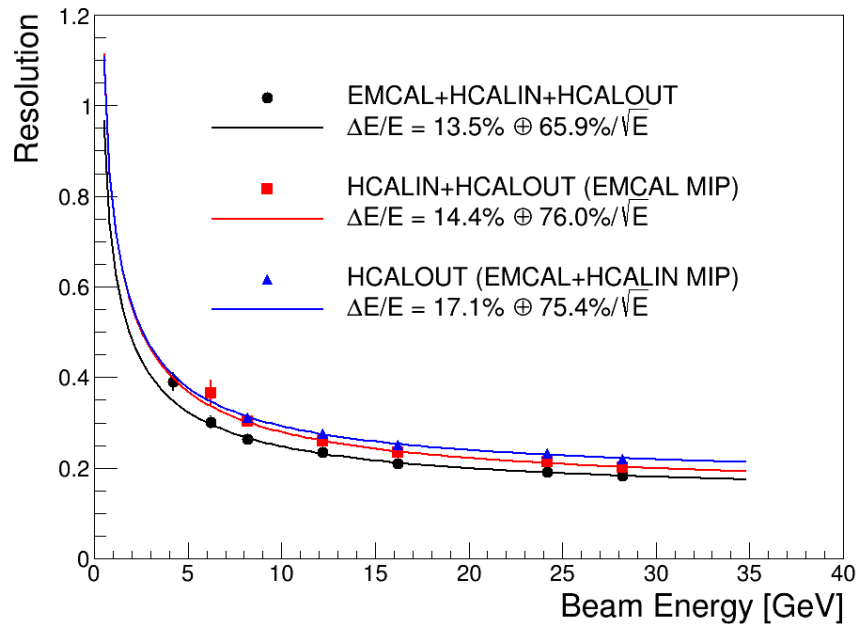
Event categorization



- Event categorization to reduce longitudinal fluctuations
 - HCALOUT (MIPs through EMCAL and Inner HCAL)
 - Shower started in outer/MIPs all calorimeters.
 - HCAL (MIPs through EMCAL)
 - Shower started either in inner/outer/MIPs all calorimeters.
- FULL
 - All showers irrespective of their start position

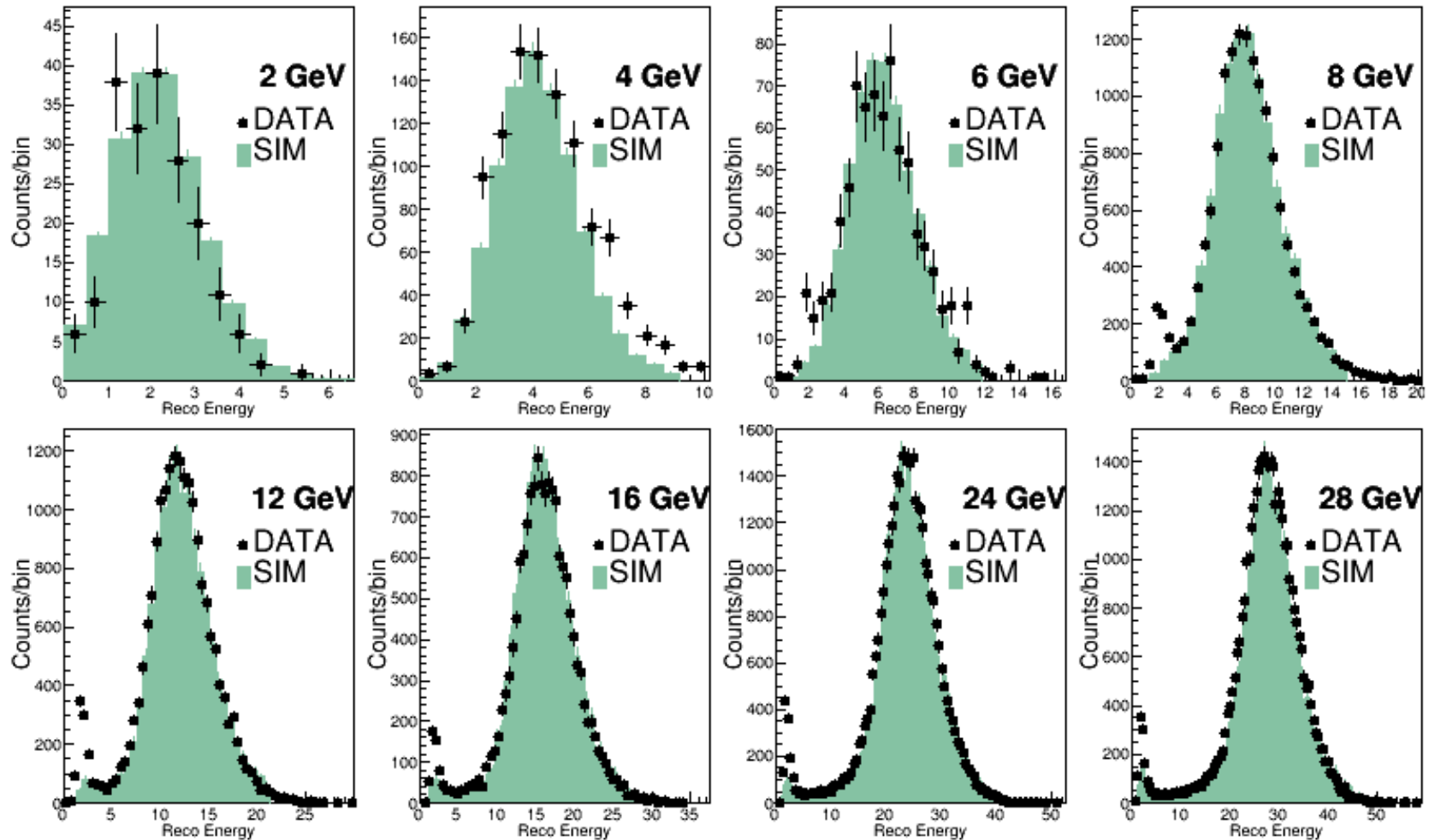
→ The shift in the mean noticed because of better hadron containment.

Resolution and linearity



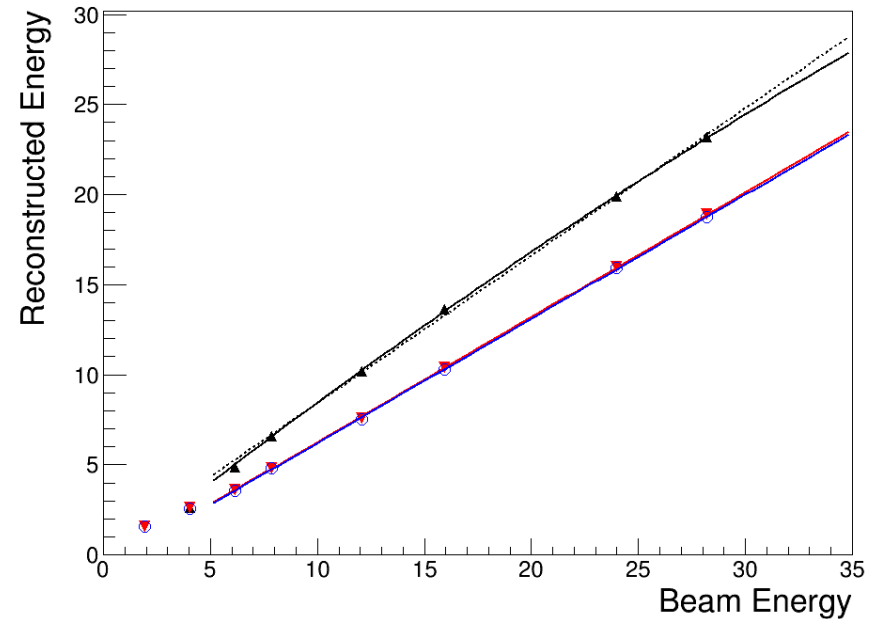
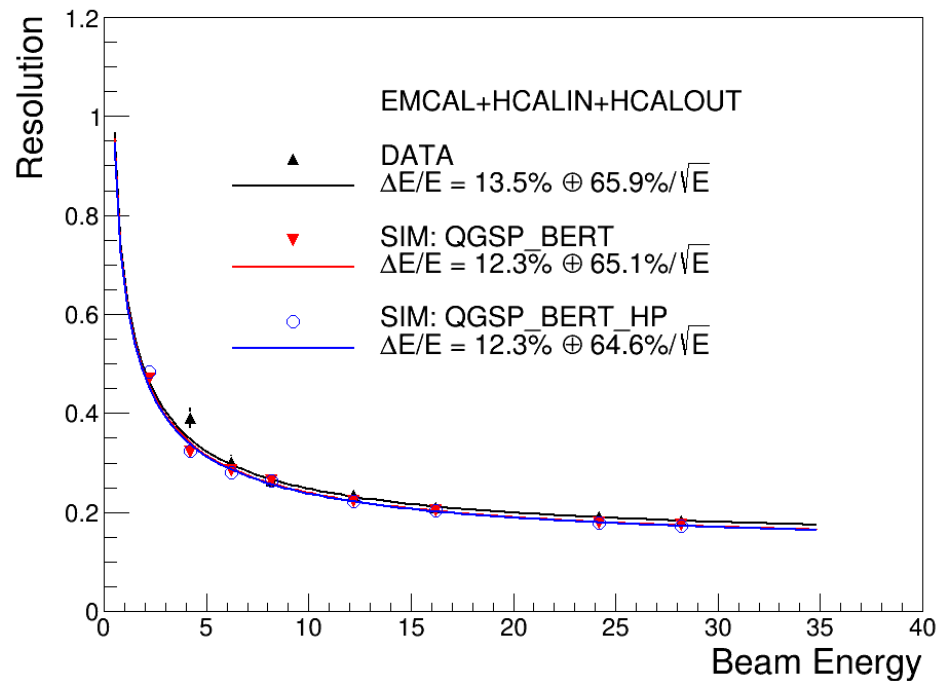
- EMCAL was also balanced with HCAL. Weight applied ~ 0.7 , no energy dependence seen.
 - Due to “h/e” since EMCAL calibration was done for electrons.
- Asymmetry cut: $(\text{EMCAL} - \text{HCAL}) / \text{sum} < 0.8$ cut applied to remove electron contaminations
- Better energy resolution observed with all three segments.
- A polynomial order 2 fits the linearity better than straight line.

Comparison with simulation



- Comparison of FULL events between data and simulations.
- Good agreement at all energies with simulation.

Comparison with simulation

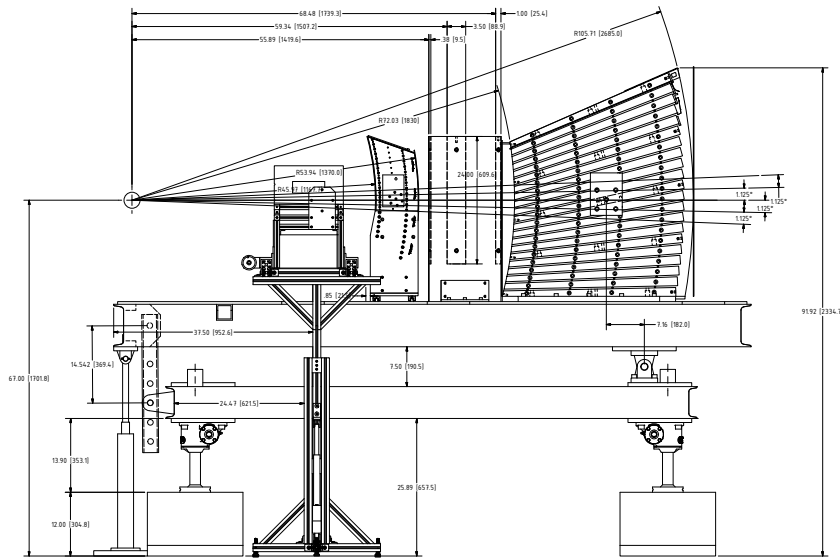


- Excellent agreement between simulation and data.
 - Two physics lists: QGSP_BERT (default) and QGSP_BERT_HP
- Linearity is quite different in simulation.

Discussion about plotsmanship. How to present in the paper.

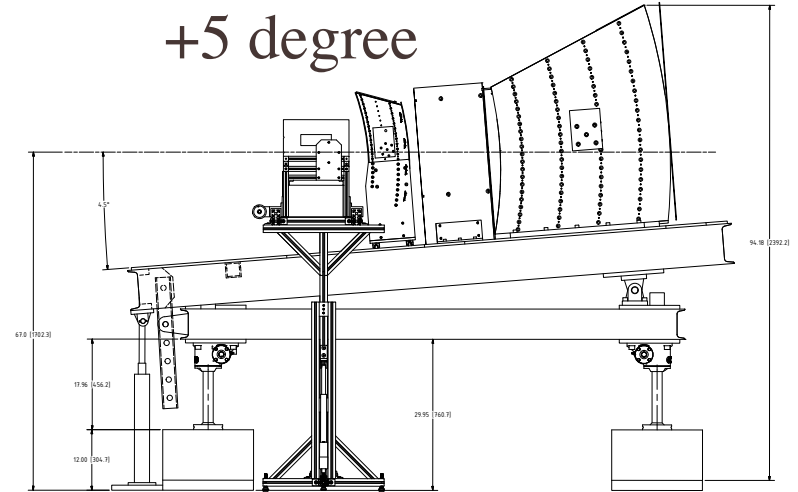
Tilting (joint)

Normal position



HORIZONTAL POSITION

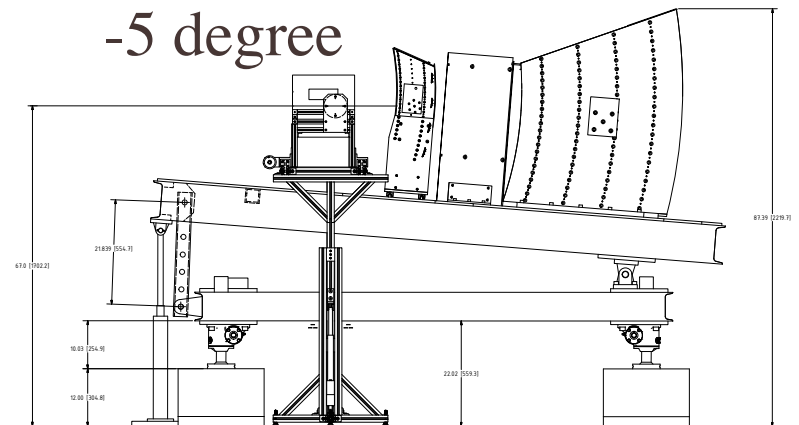
+5 degree



+4.5° POSITION

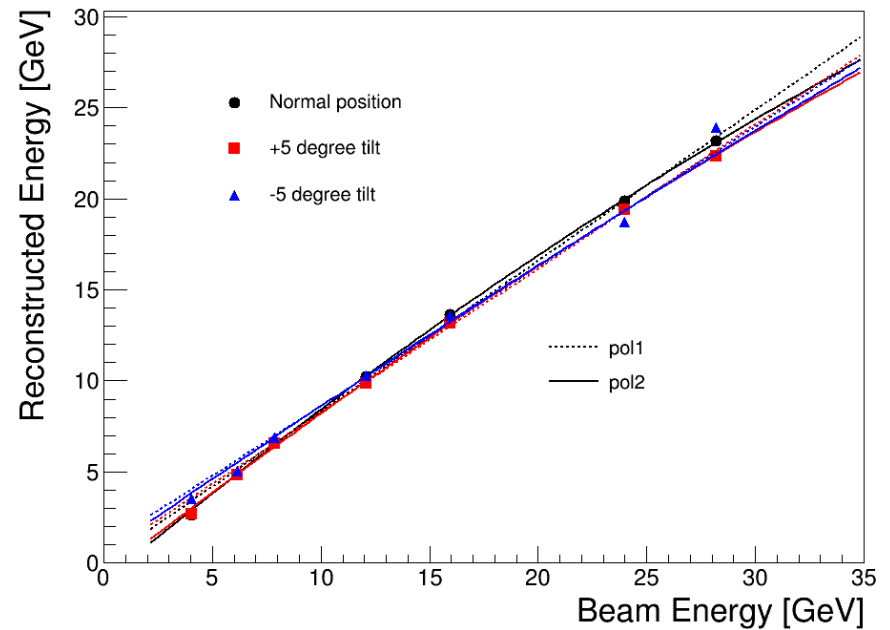
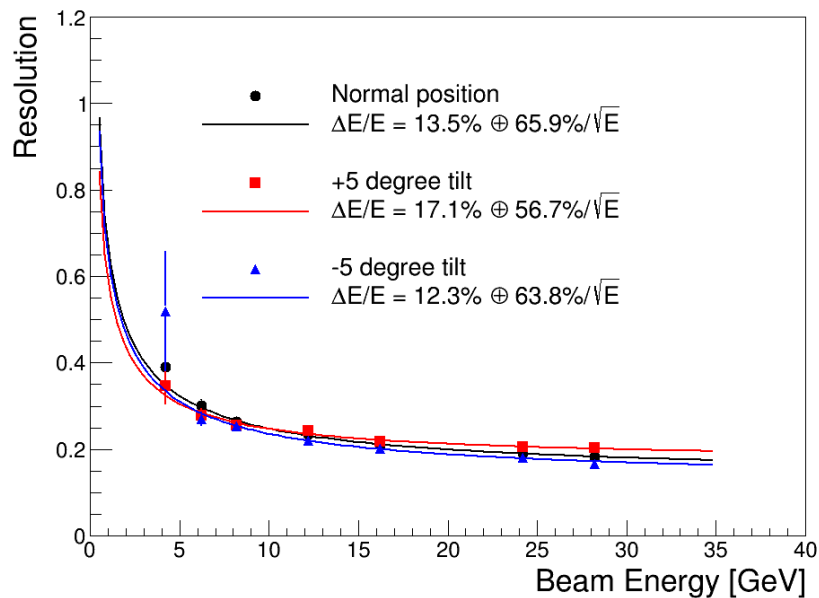
PRELIMINARY

-5 degree



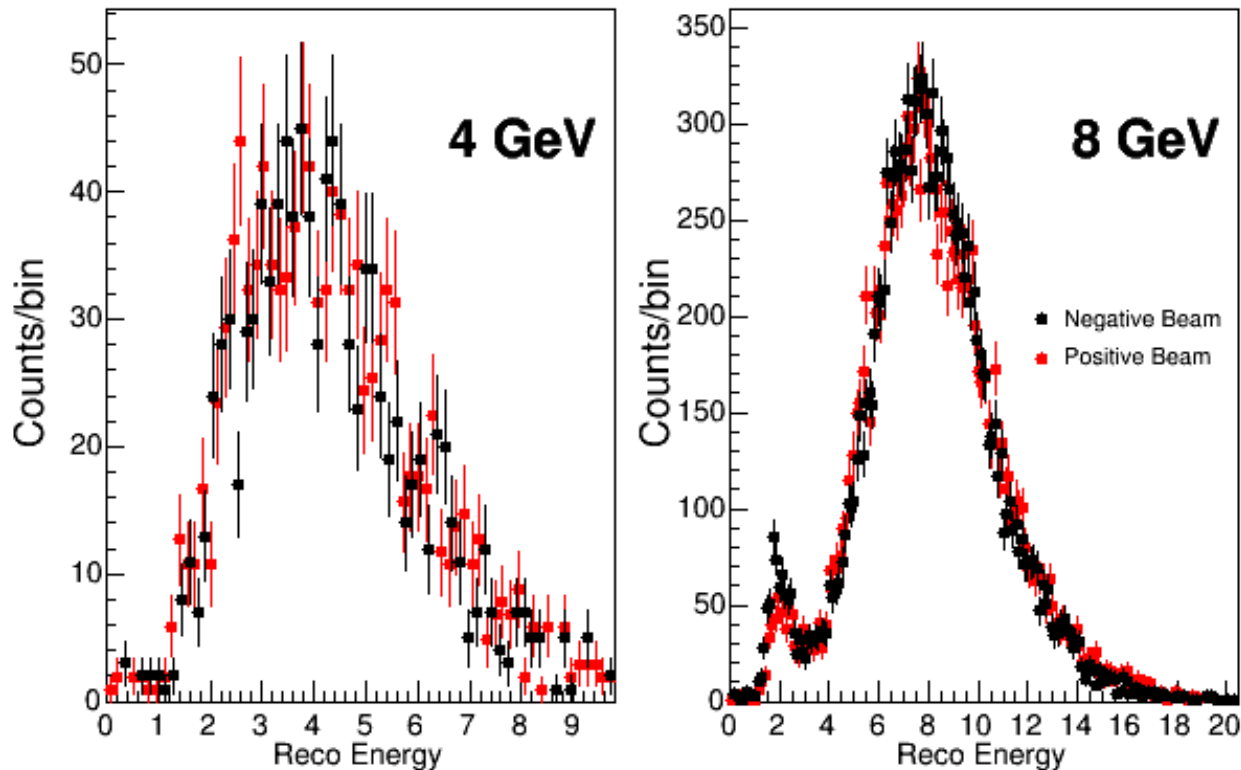
-4.5° POSITION

Resolution and linearity



- Similar resolution observed with all three configurations.
- Discussion:
 - Need to include this in the paper?

Positive and negative beam



- Most of energies collected are with negative beams.
- I only could found +4 GeV and +8 GeV that was also taken.
- Will π^+ and π^- have separate response?
 - Not likely.

BACKUP

Linearity differential: Standalone

